Blood metabolites and carcass characteristics of West African dwarf goats fed bread waste and *Moringa oleifera* leaf

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Abstract

The study evaluated the blood metabolites and carcass quality of WAD goats fed bread waste and *Moringa oleifera* leaf. The goats ($n=20$, 6-7 months old) were allotted to four treatments (5 goats per treatment) in a completely randomized design. The experiment lasted twenty weeks. Bread waste and *Moringa oleifera* were used to replace Corn bran and Brewer's dried grain (w/w) in the compounded concentrate diets at 0, 25, 50 and 100% to form treatments 1, 2, 3 and 4, respectively. The goats fed diets T2, T3 and T4 had lower ($P < 0.05$) cholesterol levels (52.83, 45.11, and 33.69 mg/dL, respectively) than T1 (54.89 mg/dL). There was no significant difference ($P > 0.05$) among the means of the hematological indices across the treatments. However, the total protein of goats fed diets T2, T3 and T4 were higher ($P < 0.05$) than those on T1. The serum metabolite of the experimental goats indicated no significant difference ($P > 0.05$) in the albumin, aspartate aminotransferase (AST) and alkaline phosphate (ALP) contents while the total protein of goats fed diets T2, T3 and T4 (6.37, 6.39 and 6.53 g/dL respectively) were higher ($P < 0.05$) than T1 (4.66). The hot carcass weights of goats fed diets T4 (4.56 kg) and T3 (4.45 kg) were higher ($P < 0.05$) than those on diets T2 (4.21 kg) and T1 (4.01kg) whereas there was no significant difference ($P > 0.05$) in the dressing percentage and head weight. The goats fed diet T1 had highest ($P < 0.05$) value for the lungs, kidney and spleen weight when compared to diets T2, T3 and T4. It could be concluded that inclusion of bread waste and *Moringa oleifera* leaf in diet of WAD goats reduced blood cholesterol level, enhanced flesh deposition in the carcass and impacted no visible abnormalities on the visceral organs.

Keywords: blood, bread waste, carcass, *Moringa oleifera*, WAD goats

Introduction

Goat production constitutes very important part of ruminant livestock sub-sector in the Nigerian agricultural economy. They are one of the most important domesticated small ruminants with a population of 29.2 million in Nigeria (Ukanwoko *et al.*, 2009). Thus, the potential of goat production in alleviating low animal protein intake by man in developing nation needs no emphasis (Ilori *et al.*, 2013). However, the high cost of conventional feedstuffs as well as rapid decline in quality of forages especially during the dry season led to development of alternative feedstuffs in goat nutrition. Hence, it is necessary to turn attention to the utilization of agro-industrial by products and forage legumes

particularly those that are inexpensive and are locally available all year round as livestock feeds. Bread is one of the most widely consumed food products in the world and bread making technology is probably one of the oldest technologies known (Selomulyo and Zhou, 2007). In Nigeria, bread is produced from wheat flour, sugar, vegetable fat, skimmed milk powder, salt, butter, flour and other ingredients, depending on the maker. It is rich in energy, low in fibre but high in vitamin (Al-Tulaihan *et al.*, 2004). *Moringa oleifera* commonly called horse radish tree is an inexpensive forage protein source for livestock feeding (Sarwatt *et al.* 2004, Odeyinka *et al.* 2008). Though literatures revealed that bread waste and *Moringa*

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possess excellent nutritional qualities, limited information is available on the inclusion of both as energy and protein sources, respectively in diets of goats. Therefore, the study examined the blood metabolites and carcass quality of WAD goats fed bread waste and *Moringa oleifera* leaf.

Materials and methods

Twenty West African dwarf goats (6–7 weeks old) of both sexes were used in this experiment. They were randomly allotted to four treatments in a Completely Randomized Design. The goats in each treatment (five goats) were housed together in a slated floor pens at the Sheep and Goat Unit. Bread waste was collected, oven dried, packaged and stored for subsequent use. Fresh *Moringa oleifera* leaves were obtained from Sheep and Goat Unit, Obafemi Awolowo University Teaching and Research farm, Ile Ife, Nigeria and air dried. Bread waste was used to replace Corn bran (w/w) as energy source while *Moringa oleifera* was used to replace Brewer's dried grain (w/w) as a protein source. Four concentrate diets (T1, T2, T3 and T4) were

compounded with inclusion of bread waste and *Moringa* leaf at 0, 25, 50 and 100%, respectively (Table 1) which were fed to the goats at 3% of their body weight. On the last day of the experiment, two sets of blood samples were taken from the goats using 5 mL syringe. One ml blood sample was collected into labeled sterile bottles containing anticoagulant free bottles, allowed to coagulate at room temperature and centrifuged at 3000 rpm for 10 minutes. The serum concentration for cholesterol, aspartate aminotransferase (AST), alkaline phosphate (ALP) and albumin were determined using commercial laboratory kit (Randox Laboratories Ltd, U.K). The red blood cell (RBC), white blood cell (WBC) and the packed cell volume (PCV) were determined using the method of Adedapo *et al.* (2007). Two goats per treatment were slaughtered by severing both the jugular veins and carotid arteries at the atlanto-occipital arthuculation (Okah, 2006). Data obtained were subjected to analysis of variance procedure of General Linear Model and the Duncan's New Multiple Range Test option of SAS (2008) was used for mean separation.

Table 1: Gross composition of experimental diets for the WAD goats

Ingredient (%)	T1	T2	T3	T4
Corn bran	40.00	30.00	20.00	-
Brewer's dried grain	40.00	30.00	20.00	-
Bread waste	-	10.00	20.00	40.00
<i>Moringa oleifera</i>	-	10.00	20.00	40.00
Palm kernel cake	16.00	16.00	16.00	16.00
Bone meal	3.00	3.00	3.00	3.00
Vitamin/mineral premix	0.50	0.50	0.50	0.50
Salt	0.5	0.5	0.5	0.5

¹Premix provided per kg diet: vitamin A, 12,000 IU; vitamin D3, 1,000 IU; vitamin E acetate, 50 mg; vitamin K3, 2 mg; biotin, 0.1 mg; Fe, 100 mg; Cu, 20 mg; Mn, 50 mg; Co, 2 mg; I, 1 mg; Zn, 100 mg; Se, 0.1 mg; Robenidine, 66 mg.

T1: 0% substitution level of BW and MO; T2: 25% substitution level of BW and MO

T3: 50% substitution level of BW and MO; T4: 100% substitution level of BW and MO

Results and discussion

There was significant difference ($p < 0.05$) in serum cholesterol level of the experimental animals (Table 2). The animals fed diets containing bread waste and *M. oleifera* (T2, T3 and T4) had lower

($p < 0.05$) cholesterol levels than T1, but there were no significant differences ($p > 0.05$) among the means of the haematological indices (Packed cell volume, White blood cells and Red blood cells) across the treatments. The serum

metabolites of the experimental goats indicated no significant differences ($p>0.05$) in the albumin, aspartate aminotransferase (AST) and alkaline phosphate (ALP) contents except for the total protein which were higher ($p<0.05$) in goats on T2, T3 and T4 compared to those on T1. Cholesterol is conventionally used for diagnosing human and domestic animal's hepatic damage (Silanikove and Tiomkin, 1992). The blood cholesterol of the goats in this study was lower than 56.80 – 103.90 mg/dL reported by Yusuf *et al.* (2012). It was observed that the blood cholesterol level of the animals fed diets containing bread waste and *M. oleifera* was far below the normal blood cholesterol values of 65 – 136 mg/dL reported by Merck (2011) hence indicating *Moringa oleifera* as a potent hypocholesterolemic agent, which agreed with the submission of Esonu *et al.* (2001) that haematological constituents reflect the physiological responsiveness of the animal to its internal and external environments (including feed and feeding). The packed cell volume in this present study was similar (28.80 – 35.60%) to the values reported by Ayandiran *et al.* (2012) but lower than 34.00 - 37.00% reported by Okah *et al.* (2014). The red blood cell and the white blood cell counts

were higher than the reported values of $8.1 - 9.7 \times 10^6$ and $5.5 - 8.7 \times 10^3$ respectively by Fayomi *et al.* (2014). However, the values of Packed Cell Volume (PCV), Red Blood Cell (RBC) and White Blood Cell (WBC) obtained in this study were within normal physiological ranges (27.0 – 45.0%, $9.0 - 15.0 \times 10^6$ and $4.0 - 12.0 \times 10^3$, respectively) reported by Jain (1993). The total protein observed for WAD goats fed diets T2, T3 and T4 in this study was within the range of 6.1 - 7.5 g/dL reported by Merck (2011) whereas significantly lower total protein of goats fed T1 diet is an indication of the relatively poor protein quality of the diet, the level and availability of the dietary protein (Olafadehan, 2011). The albumin level of goats in this study was lower than 3.90 – 4.45 u/L reported by Yusuf *et al.* (2012) but similar to that obtained by Oyebanji and Ayandiran (2014). All the experimental goats were within the range of 2.7 - 4.4 g/dL for globulin (Merck, 2011). Serum AST, ALP, albumin and total protein levels are known to be useful in assessing the functional integrity of the liver (Baez *et al.*, 2007). Differences in serum biochemical parameters may be caused by nutrition, environment and hormonal factors (Chineke *et al.*, 2002).

Table 2: Haematological and serum metabolites of the WAD goats

Parameter	T1	T2	T3	T4	SEM	PROB.
Cholesterol (mg/dL)	54.89 ^a	52.83 ^a	45.11 ^b	33.69 ^c	5.01	0.04
Packed cell volume (%)	35.33	31.83	32.67	33.67	3.16	0.38
Red blood cell (10^6)	13.47	12.80	12.20	12.47	1.08	0.73
White blood cell (10^3)	10.07	10.00	11.13	11.33	0.56	0.20
Total protein (g/dL)	4.66 ^b	6.37 ^a	6.39 ^a	6.53 ^a	0.26	0.02
Albumin (g/dL)	2.96	2.65	2.72	3.07	0.09	0.52
Globulin (g/dL)	1.70 ^b	3.72 ^a	3.28 ^a	3.46 ^a	0.35	0.05
AST (g/dL)	17.73	17.41	17.34	18.09	1.22	0.21
ALP (g/dL)	4.02	3.92	3.76	4.10	0.32	0.51

^{abc}: Means in a row with different superscripts differ significantly ($p<0.05$)

AST: Aspartate aminotransferase, ALP: Alkaline phosphate

T1: 0% substitution level of BW and MO, T2: 25% substitution level of BW and MO

T3: 50% substitution level of BW and MO, T4: 100% substitution level of BW and MO

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There was significant difference ($p < 0.05$) in the carcass quality parameters of goats fed bread waste and *M. oleifera*. The hot carcass weight of animals fed diets T3 and T4 were significantly higher ($p < 0.05$) than animals on diets T1 and T2 whereas there was no significant difference ($p > 0.05$) in the percentage dressed and head weight. The neck value was significantly highest in animals fed diet T4, followed by T1 then T2 and T3 which were significantly the same. Furthermore, the shoulder weight was higher ($p < 0.05$) in animals fed diet T1 than T2, T3 and T4. The diets T1 and T2 were comparable ($p > 0.05$) in the feet weight but significantly higher than T3 and T4 while the skin percentage followed similar trend as the shoulder weight. However, animals fed T4 diet had significantly highest ($p < 0.05$) loin weight than T3, T2 and the least T1. There was significant difference ($p < 0.05$) in the visceral organs of animals fed the experimental diets. The liver weight was significantly highest ($p < 0.05$) in diet T1, followed by T2, T3 and T4. Moreover, diets T4 and T3 had significantly highest ($p < 0.05$) heart weight than diets T2 and T1. However, the animals fed diet T1 had significant highest ($p < 0.05$) value for the lungs, kidney and spleen weights than diets T2, T3 and T4 containing bread waste and

M. oleifera whose values were significantly similar throughout the treatments. The carcass and cut parts values of animals depend on how adequately the animals were able to utilize nutrients in feed to synthesize body tissues (Okah *et al.*, 2014). There was no significant difference in the means of the dressing percentage of animals in this study as also reported by Simela *et al.* (2011). However, the value in this study was lower than 46.54% reported by Alkass *et al.* (2014) but comparable to 40.56 – 43.28% obtained by Odoemelam *et al.* (2014). The shoulder and leg in this present experiment percentage was relatively similar to 18.05 – 10.74% and 9.20 – 11.69% recorded respectively by Okah *et al.* (2014) but lower than the values reported by Odoemelam *et al.* (2014). The loin percentage was comparable to 8.05 – 13.15% obtained by Okah *et al.* (2014). Moreover, the skin was also within the range 9.73 – 13.14% reported by Odoemelam *et al.* (2014). The percentage of all internal organs in this study was higher than values reported by Okah *et al.* (2014) for WAD buck fed differently processed poultry droppings. The relative organ weights (liver, lungs, kidney and spleen) were significantly higher in the control diet (T1). This shows that substitution of bread waste and *M.*

Table 3: Carcass quality of goats fed the experimental diets

Parameter	T1	T2	T3	T4	SEM	PROB.
Slaughter weight (kg)	9.88	10.87	10.63	11.38	0.37	0.25
Hot carcass (kg)	4.01 ^b	4.21 ^b	4.45 ^a	4.56 ^a	0.08	0.01
Dressing (%)	41.12	39.66	41.66	40.14	0.36	<0.0001
Head (%)	21.41	21.42	19.74	20.27	0.31	0.14
Neck (%)	8.47 ^b	7.65 ^c	7.67 ^c	8.91 ^a	0.21	<0.0001
Shoulder (%)	11.00 ^a	10.06 ^b	9.50 ^b	9.70 ^b	0.12	0.05
Feet (%)	8.28 ^a	7.78 ^a	7.07 ^b	6.82 ^a	0.22	0.01
Loin (%)	10.50 ^c	10.00 ^c	11.90 ^b	12.65 ^a	0.20	<0.0001
Liver (%)	5.29 ^a	3.78 ^b	3.47 ^b	2.92 ^c	0.33	<0.0001
Heart (%)	1.29 ^c	1.39 ^b	1.47 ^a	1.42 ^a	0.03	<0.0001
Lungs (%)	2.85 ^a	2.38 ^b	2.34 ^c	2.40 ^b	0.08	<0.0001
Kidney (%)	1.26 ^a	1.18 ^{ab}	1.17 ^{ab}	1.09 ^b	0.03	0.03
Spleen (%)	1.40 ^a	0.67 ^b	0.61 ^b	0.59 ^b	0.13	<0.0001

^{abc}: Means in a row with different superscripts differ significantly ($p < 0.05$)

T1: 0% substitution level of BW and MO, T2: 25% substitution level of BW and MO

T3: 50% substitution level of BW and MO, T4: 100% substitution level of BW and MO

oleifera leaf in the diets of WAD goats promoted the growth of somatic cells for flesh deposition, but discouraged the growth of visceral organs.

Conclusion

It could be concluded that inclusion of bread waste and *Moringa oleifera* leaf in the diet of WAD goats reduced blood cholesterol level, enhanced flesh deposition in the carcass and impacted no visible abnormalities on the visceral organs.

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